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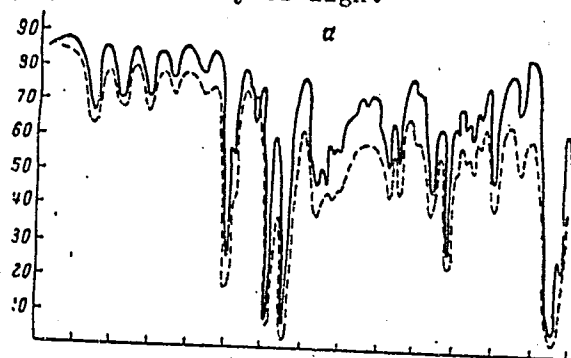
Effect of fast electrons ...

S/190/61/003/002/004/012  
B130/B202

J. Phys. Chem., 61, 129, 1957; C. J. Liang, S. Krimm, J. Polymer Sci., 27, 241, 1958; H. L. McMurtry, V. Thornton, Anal. Chem., 24, 318, 1959.

SUBMITTED: June 14, 1960

Legend to Fig. 1: infrared spectra a) atactic polystyrene (molecular weight 1,300,000,  $d = 45 \mu$ ); b) isotactic polystyrene,  $d = 30 \mu$ ; c) atactic polystyrene (molecular weight 600,000,  $d = 45 \mu$ ) not irradiated: solid lines, irradiated: dashed lines y) transmissivity of light

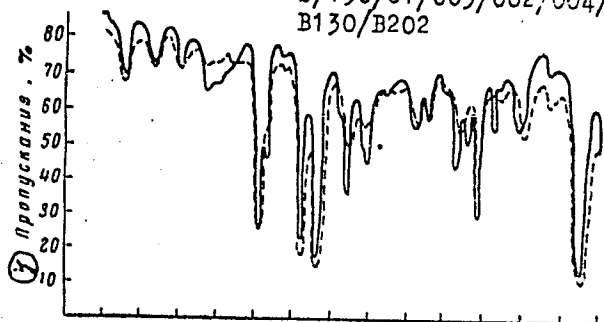


Card 3/4

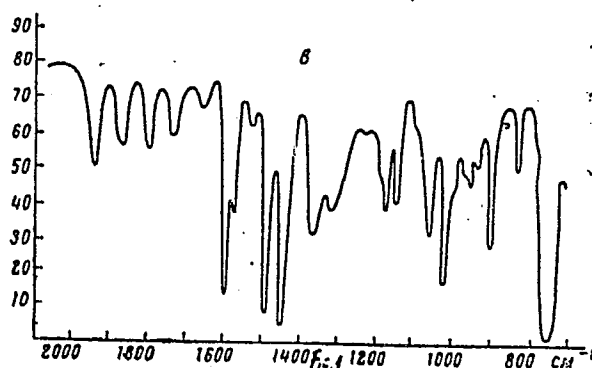
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Effect of fast electrons .

S/190/61/003/002/004/012  
B130/B202



Card 4/4



89590

S/190/61/003/002/008/012  
B101/B215

15.8600 2209

AUTHORS: Plate, N. A., Shibayev, V. P., Patrikeyeva, T. I.,  
Kargin, V.A.

TITLE: Synthesis and properties of grafted copolymers of isotactic  
and atactic polystyrene

PERIODICAL: Vysokomolekulyarnyye soyedineniya, v. 3, no. 2, 1961,  
292-298

TEXT: In previous papers, the authors together with other collaborators,  
(Refs.1-4: Vysokomolek. soyed. 1, 114, 1959; 1, 1101, 1959; 1, 1547, 1959;  
2, 166, 1960) studied grafted copolymers of chemically and physically  
different components. The present paper reports on the examination of  
grafted copolymers consisting of chemically equal chains which are  
different in structure: copolymers with crystalline, isotactic poly-  
styrene main chains, and amorphous, atactic polystyrene side chains.  
They were produced by ozonization of isotactic polystyrene (PS) whose  
atactic fraction was washed out by boiling methyl-ethyl ketone. The  
fraction insoluble in this solvent, had a molecular weight of 80,000.

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89590

Synthesis and properties of grafted...

S/190/61/003/002/008/012  
B101/B215

Ozonization was conducted in a glass vessel. The experimental conditions are given in a table. After the reaction,  $N_2$  was blown through the apparatus, and evacuated at room temperature; the content of active  $O_2$  in the sample was determined by elementary analysis. Ozonization of PS films was less effective due to the difficult diffusion of ozone. In agreement with P. Lebel (Ref.10: Thesis, Paris 1957), the infrared spectrum showed no OH bands thus proving the absence of hydrogen peroxide. Peroxide of experiment no. 5 (see table) served as initiator for the polymerization of atactic styrene monomer. The latter was carried out in phials, either in argon atmosphere or in high vacuum. The optimum was found to be: 1 hr of heating up to  $60^\circ C$ , then 2 hr up to  $65^\circ C$ , 3 hr up to  $70^\circ C$ , and finally 2 hr up to  $75^\circ C$ . Faster increase in temperature led to the formation of network. In solutions (benzene, toluene), polymers of lower degrees of grafting were obtained. Atactic homopolystyrene (side product of the reaction) was removed by a 10 - 15 hr treatment with methyl-ethyl ketone. The molecular weight of the product was 200,000. Grafted copolymers with 17, 31, and 35%

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Synthesis and properties of grafted...

S/190/61/003/002/008/012  
B101/B215

contents of atactic components were obtained. Fig. 2 shows a diagram of turbidimetric titration of atactic polystyrene, mechanic mixtures of 35% of atactic plus 65% of isotactic PS, grafted copolymer with 35% of an atactic component, and isotactic PS (solvent: tetralin, precipitant: butanol). The solubility of the grafted copolymer was lower than that of the linear isotactic PS due to larger macromolecules, but higher than that of atactic PS due to the formation of branched chains. The determination of intrinsic viscosity showed the following results: the initial isotactic PS had a Huggin's constant  $k' = 0.10$ .  $k'$  of the grafted copolymers was 0.40, and  $k'$  of copolymers with different contents of atactic components, in agreement with J. A. Manson, L. H. Gragg (Ref.12: *Angew. Chem.* 67, 32, 1955), showed no remarkable differences. Fig. 4 gives the thermomechanical properties of the copolymers. The grafted copolymers were found to have a distinct vitrification temperature ( $90^{\circ}\text{C}$ ), and a high melting point ( $220-230^{\circ}\text{C}$ ) characteristic of isotactic PS. This is explained by the fact that the structural order of the isotactic component is preserved in the copolymer. Within these two temperatures, the copolymers showed the ability of reversible, highly elastic deformation which was not accompanied by recrystallization. A radiographic analysis

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Synthesis and properties of grafted...

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showed that grafting of 17% of the atactic component did not change the diffraction of isotactic PS.. 31% of the atactic component showed wider diffraction lines. The examination of copolymers of crystalline and amorphous components is considered to be an important problem.

I. Yu. Marchenko (Ref.13: Vysokomolek. soyed., 2, 549, 1960) is mentioned. There are 5 figures, 1 table, and 13 references: 9 Soviet-bloc and 4 non-Soviet-bloc. The reference to English language publication reads as follows: Y. Landler, Materials of the Gordon Scientific Conference, USA, 1958.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova  
(Moscow State University imeni M. V. Lomonosov)

SUBMITTED: August 1, 1960

Card 4/7

15.8600

2209

S/190/61/003/002/009/012  
B101/B215

AUTHORS: Kargin, V. A., Shibayev, V. P., Plate, N. A.

TITLE: Ordering processes in systems containing grafted copolymers on the basis of isotactic and atactic polystyrene

PERIODICAL: Vysokomolekulyarnyye soyedineniya, v. 3, no. 2, 1961, 299-305

TEXT: It was the purpose of the present work to study the influence of grafting on the ordering processes and crystallization in polymer systems by electron microscopes. Grafted copolymers obtained from isotactic and atactic polystyrene (PS) were used for the investigation. The content of the atactic component was 17% in one sample and 35% in the other. A JEM-5Y electron microscope with direct, 20,000-70,000-fold electron-optical magnification was used for the experiments. The crystallization of polymers dissolved in toluene (concentration of 0.01%) was conducted at 110°C on colloxylin film hardened by quartz or coal. The first electron-microscopical photographs showed no difference between copolymer and crystalline PS. For finding the difference, the film had to be heated

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Ordering processes in systems ...

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B101/B215

up to 140°C. The mixture of crystalline and grafted copolymers then showed a variety of intermediate stages between spherulitic and crystalline formations whose thickness was 150-200 Å. Fibrils (40-50 Å) became visible after heating up to 160°C. With tetralin as solvent, distinct packet structures occurred (250-400 Å). The presence of the copolymer thus inhibits crystallization and causes a variety of intermediate formations. To study the fine structure of the pure copolymer, crystalline PS additions were precipitated from tetralin by methanol, and boiled in heptane for 30 hr. After this reprecipitation the product, originally insoluble in methyl-ethyl ketone, has become soluble up to 40%. Hence, it was concluded that grafting only takes place on the surface of the crystal packages of insoluble, isotactic PS under heterogeneous conditions. The solubility of the product depends on whether the isotactic main chain remains in direct neighborhood of the macromolecules of crystalline PS which did not enter into reaction. Fig. 2 shows the radiographs taken during separation by recrystallization. The electron-microscopical examination of the pure, grafted copolymer showed coiled globules of 40-50 Å. The authors thank N. F. Bakeyev for collaboration and discussion. There are 3 figures and 16 references: 9 Soviet-bloc and 7 non-Soviet-bloc.

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Ordering processes in systems...

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S/190/61/003/002/009/012  
B101/B215

The 3 references to English language publications read as follows:  
H. C. Haas, S. J. Cohen, A. C. Oglesby, E. R. Carlin, J. Polymer Sci.,  
15, 427, 1955; P. H. Till, J. Polymer Sci., 24, 301, 1957; W. D.  
Niegisch, J. Polymer Sci., 40, 263, 1959

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova  
(Moscow State University imeni M. V. Lomonosov)

SUBMITTED: August 1, 1960

Card 3/4

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11 2210

S/190/61/003/003/007/014  
B101/B204

AUTHORS: Kargin, V. A., Kabanov, V. A., Zubov, V. P., Papisov, I.M.

TITLE: Initiation of low-temperature polymerization in systems  
that have been obtained by the molecular beam method

PERIODICAL: Vysokomolekulyarnyye soyedineniya, v. 3, no. 3, 1961,  
426-434

TEXT: In earlier papers, (Ref. 1: Vysokomolek. soyed. 1, 265, 1959;  
Ref. 2: Vysokomolek. soyed., 1, 1422, 1960; Ref. 3: Vysokomolek.  
soyedineniya, 1, 1859, 1959; Ref. 6: Vysokomolek. soyed. 2, 303, 1960,  
Ref. 4: V. A. Kabanov, Thesis, Moscow, 1960) the present authors showed  
that a few monomers when condensed together with metals, inorganic salts,  
or oxides may enter polymerization upon a cold surface at the melting  
temperature or even below it. When the usual methods are used, these  
substances (metals, salts, oxides) are absolutely inert. It was the  
aim of the present investigation to disclose the initiation in these  
systems. A) The systems monomer + metal: Rapid, explosive polymeriza-  
tion was attained by simultaneous condensation of vaporized magnesium and

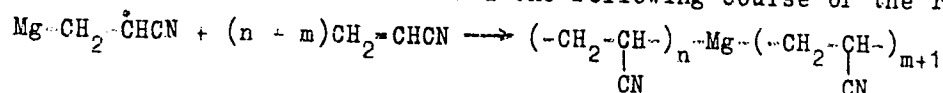
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Initiation of low-temperature ...

S/190/61/003/003/007/014  
B101/B204

acrylonitrile, methacrylonitrile, methacrylate, isopropylacrylate, methyl methacrylate, acryloamide, methacryloamide, butylester of ethylene sulfonic acid, dibutylester of vinylphosphinic acid, formaldehyde, acetaldehyde, and acetone upon a surface cooled with liquid nitrogen. The authors employed the arrangement shown in Fig. 1 in order to explain this mechanism. This apparatus may reduce the overlapping of both molecular beams in the gaseous phase in the case of simultaneous condensation of the monomer (1) and magnesium (2) upon the cooled surface (3). It was found that in this case a polymer does not form. Thus, polymerization takes place only when the vapors interact. From epr spectra it was found that free magnesium-organic radicals form when magnesium and acrylonitrile vapor are condensed simultaneously. The analyses showed that the polyacrylonitrile formed under these circumstances contained Mg which could be extracted by hydrolysis with diluted HCl. In this case, the molecular weight (130,000 and 110,000) dropped to about half of its former value. From this, the authors concluded the following course of the reaction:



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89/9/1

Initiation of low-temperature...

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Further experiments showed that also atomic hydrogen initiates the polymerization of acrylonitrile, methyl methacrylate, and styrene. When Mg was heated on a tungsten spiral up to 2500°C it reacted also with less active monomers, as vinyl acetate. In the same way Zn, Cd, and Hg could be activated. The authors assume that, similar to the results obtained by Steacie (Ref. 9: see end of abstract) and Laidler (Ref. 10: see end of abstract), initiation is due to the excitation of the metal atoms:  $\text{CH}_2=\text{CHR}-\text{Me}^* \rightarrow \text{MeH} + \text{CH}=\text{CHR}$ . Lead or tin vapors do not initiate the polymerization of acrylonitrile, but even hinders it when Mg is present, due to an addition of the free radicals. B) The systems monomer + salt and monomer + oxide: Joint condensation of molecular beams of styrene,  $\alpha$ -methyl styrene, or isoprene with water-free  $\text{BeCl}_2$ ,  $\text{ZnCl}_2$ ,  $\text{TiCl}_3$ , and of the first two compounds with  $\text{MoO}_3$  leads to a rapid polymerization near the melting point of the intensely colored molecular mixture. The formation of  $\pi$  complexes with double bonds is characteristic of the mentioned organic compounds. They only initiate the polymerization of monomers which contain a dense electron cloud at the double bond. The authors assume a cationic mechanism, according to A. R. Gantmakher and S. S. Medvedev (Ref. 11: Vysokomolek. soyed. 1, 1331, 1959). Perfect crystals

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Initiation of low-temperature...

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of these catalysts were not very active, whereas polymerization could be brought about at room temperature through vacuum-vaporized crystal films containing enough surface defects. NaCl and KCl do not initiate the polymerization of monomers with electropositive substituents. However, with negatively substituted monomers, as acrylonitrile, polymerization occurred below the melting point of acrylonitrile in the case of joint condensation, when the salt was heated by means of a tungsten spiral. This process is explained by a partial dissociation. Small regions with non-stoichiometric metal atoms in the lattice are forming, and thus F centers which initiate polymerization by giving their electron to the monomer and forming an anionic radical. As the ionization potential of the F center (2.2 v for KCl) is lower than that of a free atom (4.3 v for a K atom), these F centers are intense initiators. The phase of the catalysts and initiators of the investigated systems depends on the ratio of the aggregation rate of the molecularly dispersed catalyst to the rate of polymerization. Thus, a continuous transition from homogeneous to heterogeneous catalysis may be attained. In all the cases investigated the processes were found to be highly specific due to the nature of the monomer and of the catalyst or initiator. There are

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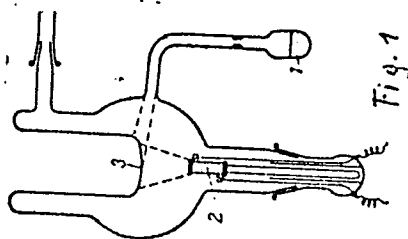
Initiation of low-temperature...

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B101/B204

4 figures and 17 references: 14 Soviet-bloc and 3 non-Soviet-bloc.  
The 3 references to English-language publications read as follows:  
P. F. Onyon, J. Polymer Sci., 37, 315, 1959; E. W. R. Stacie, Atomic  
and Free Radical Reactions, N. Y., 1946; K. J. Laidler, J. Chem. Phys.  
15, 712, 1947.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova  
(Moscow State University imeni M. V. Lomonosov)

SUBMITTED: August 1, 1960



Card 5/5

5.4500

1273, 1304, 2209

21130

S/190/61/003/004/003/014

B101/B207

AUTHORS: Slovkhotova, N. A., Sadovskaya, G. K., Kargin, V. A

TITLE: Effect of fast electrons upon the polyethylene terephthalate structure

PERIODICAL: Vysokomolekulyarnyye soyedineniya, v. 3, no. 4, 1961, 515-520

TEXT: It was the aim of the present study to clarify whether, in the case of ionizing irradiation of polyethylene terephthalate (PETP) 1) cross linking (according to A. Charlesby, Nature, 171, 167, 1953); 2) destruction (according to E. Little, Nature, 173, 650, 1954 and A. Todd, Nature, 174, 613, 1954), occur, or if 3) both processes take place. The studies were made on 5-25  $\mu$  thick PETP films, orientated by rolling. The sample was irradiated by means of a 200-kv accelerator at  $10^{-4}$  mm Hg, and room temperature. Structural change was recorded by means of an M-800 (N-800) infrared spectrophotometer, the electron spectra were recorded by means of an C $\Phi$ -4 (SF-4) spectrophotometer. Furthermore, the solubility of the irradiated polymer samples was examined in o-chlorophenol. The following papers are discussed: D. Grime,

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Effect of ...

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J. Ward (Trans. Faraday Soc., 54, 959, 1959), W. W. Daniels, K. E. Kitson, (J. Polymer Sci., 33, 161, 1958), A. Miyake, (J. Polymer Sci., 38, 479, 1959), and C. Z. Liang, S. Krimm, (J. Molec. Spectroscopy, 3, 554, 1958). From the fact that the broad band with maxima at 1470 and 1445  $\text{cm}^{-1}$  of irradiated PETP changes after irradiation, with the 1445  $\text{cm}^{-1}$  band intensity increasing, the 1470  $\text{cm}^{-1}$  band, however, vanishing, or being greatly weakened, it is concluded that the group  $\text{—O—CH}_2\text{—CH}_2\text{—O—}$  passes over from the trans- into

the gauche configuration with part of the radiation energy being transformed into oscillation energy. The fact, that, after one hour of heating to 140°C, the intensity of the bands corresponding to the crystalline structure and the trans-configuration increases somewhat, indicates the reversibility of the transformation, and a few cross-linkings. The considerable shift of the boundary of absolute absorption in the electron spectra toward great wave lengths (Fig. 2), as well as the occurrence of characteristic bands in the IR spectrum proves the formation of conjugate polyphenyl systems. The solubility of PETP in o-chlorophenol decreased from 70% to 15% when the radiation dose was increased from 250 to 500 Mrad. At the same time, the capability of swelling in o-chlorophenol increased from 800 to 2200%. Accordingly,

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Effect of ...

besides cross linking, also destruction processes occur. The energy for these two processes is higher than that required for the cross linking of styrene. The isomerization observed in individual sections of the polymer chain indicates that the energy transfer is accompanied by a deformation wave. There are 2 figures and 12 references: 4 Soviet-bloc and 8 non-Soviet bloc. The references to English language publications are given in the text of abstract.

ASSOCIATION: Fiziko-khimicheskiy institut im. L. Ya. Karpova  
(Physicochemical Institute im. L. Ya. Karpov)

SUBMITTED: June 30, 1960

Card 3/4

21139

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S/190/61/003/004/014/014  
B101/B207

AUTHORS: Kargin, V. A., Plate, N. A., Zhuravleva, V. G.,  
Shibayev, V. P.

TITLE: Structure and properties of the product of codispersion  
of polyethylene and carbon black

PERIODICAL: Vysokomolekulyarnyye soyedineniya, v. 3, no. 4. 1961,  
650-654

TEXT: The authors aimed at preparing a graft copolymer from polyethylene (PE) and carbon black, and at investigating its physical properties. They proceeded from the assumption that in the mechanical dispersion of carbon black on newly formed surfaces active centers develop which react with the macroradicals formed by dispersion of PE. The experiments were carried out with ISAF carbon black, with a specific surface of  $100 \text{ m}^2/\text{g}$ , and PE of high density, whose intrinsic viscosity in decaline was equal to 1.1 at  $100^\circ\text{C}$ . Dispersion was performed for 1.5 hr by means of a vibratory mill at room temperature. The method has already been described in Ref. 2 (N. A. Plate et al., Vysokomolek. soyed., 1, 1713, 1959). The ratio PE: carbon black was

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B101/B207

Structure and ...

equal to 1 : 1, 2 : 1, 5 : 1, and 7 : 1. The mixture formed was treated with hot benzene. A fine carbon black suspension formed in the PE solution from which, when cooled, PE adsorbed the entire carbon black into the precipitate. When introducing a paper filter into the 1% hot solution of carbon black containing PE in p-xylene, a 4 cm broad continuous transition from black to colorless was observed, while a mechanical mixture from separately dispersed carbon black and PE showed a clear borderline of carbon black separation on the filtering paper; thus, from the formation of a chemical compound consisting of PE and carbon black at codispersion is assumed. Study by means of a JEM-5Y electron microscope, 30,000-60,000 fold magnification, of samples obtained by evaporation of the 0.01% solution of the polymer in p-xylene showed that, beside aggregates of non-reacted carbon black and the spherulites of PE, also packed structures had been formed. A mechanical mixture from separately dispersed PE and carbon black showed only carbon black aggregates and PE spherulites. It is concluded that PE crystallization is inhibited by the presence of the graft polymer from PE and carbon black. The packed structures form in such a way that the carbon black particles chemically linked with PE, are located in the interpacked space and cause plastification of PE. X-ray analysis showed no difference between

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B101/B207

Structure and ...

copolymer and PE. Fig. 4 gives the result of the mechanical test by means of Polyani dynamometer. The graft copolymer showed a higher elasticity than the mechanical mixture. Moreover, the resistivity of the toluene solution of the graft copolymer was at 70°C twice as high as that of the mechanical mixture. Thus, the contact between the channel black particles was reduced due to their chemical bonding to PE. Since in dispersion of PE, its molecular weight was not reduced, it is assumed the newly formed carbon black surfaces react with the macromolecules of PE. The results are compiled as follows: 1) Slight quantities of graft copolymer form in the joint vibratory grinding of PE and carbon black. 2) This homogenized system does not dissolve into its components when left standing. 3) Thus, it is possible to introduce large quantities of carbon black into PE. 4) Highly elastic products are, however, likely to be obtained only by subsequent vulcanization. T. A. Koretskaya is mentioned. There are 4 figures and 6 references: 4 Soviet-bloc and 2 non-Soviet-bloc. The 2 references to English-language publications read as follows: E. Dannerberg et al., J. Polymer Sci., 31, 127, 1958.

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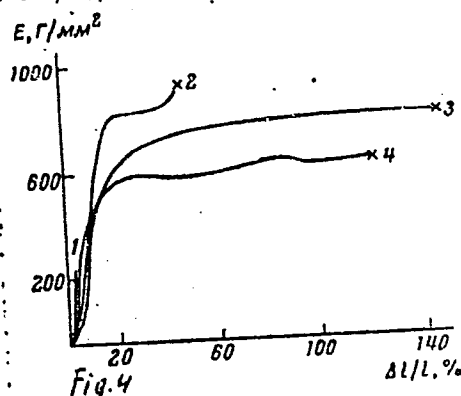
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B101/B207

Structure and ...

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova  
(Moscow State University im. M. V. Lomonosov)

SUBMITTED: October 8, 1960

Fig. 4: Force-elongation diagrams at 25°C. Legend: 1) Mechanical mixture from dispersed PE and carbon black 7 : 1; 2) product of joint PE and carbon black dispersion, 7 : 1; 3) initial PE; 4) PE, dispersed without carbon black.



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KARGIN, V.A.; KABANOV, V.A.; RAPOPORT-MOLODTSOVA, N.Ya.

Mechanochemical initiation of the polymerization of crystalline acrylic acid salts. Vysokom.sped. 3 no.5:787-793 My '61. (MIRA 14:5)

1. Moskovskiy gosudarstvennyy universitet imeni M.V.Lomonosova.  
(Acrylic acid) (Polymerization)

15 2310

1043.2209, 1372

23760

S/190/61/003/006/001/019  
F110/B216

AUTHOR: Berestneva, G. L., Berestnev, V. A., Gatovskaya, T. V.,  
Kargin, V. A., Kozlov, P. V.

TITLE: Orderly precrystalline structure of polymers

PERIODICAL: Vysokomolekulyarnyye soyedineniya, v. 3, no. 6, 1961,  
801 - 805

TEXT: Before crystallization, the chain molecules of polymers in the amorphous state may be in an orderly state, even before the occurrence of long-range order. Crystallization with formation of large structures (spherulites) is therefore often very rapid, requiring little energy, when polymers are converted from the vitreous to the highly elastic state. A mechanical field applied to a polymer with precrystalline orderly structure may destroy the latter. Further elongation leads to the formation of new oriented structures, which are studied in the present work. The rapidly crystallizing polyethylene terephthalate (PETP) was used for the study, crystallization being observed by crystal analysis, thermodynamically, and visually by the turbidity caused by the formation of interferences.

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Orderly microcrystalline ...

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2110 211

The PETP films were heated (A), treated with acetone (B), or elongated at room temperature by 50 and 400 percent. The films were investigated (C) by optical examination (Birchfield), by the compensation method, (D) by thermogravimetric studies, sorption of acetone vapor using spring weights at 25°C and (E) determination of the integral heat of wetting in acetone in the adiabatic calorimeter and (F) measurement of density changes by means of graduated tubes. The crystallinity was determined by X-ray analysis. Fig. 1 shows the sorption isotherms of acetone by PETP films. The table gives experimental data of various film samples, obtained by calculation of the specific surface from sorption data obtained by (A), (C) and (D) using the equation of S. Brunauer, P. H. Emmett, E. Teller (BET) (Ref. 11: J. Amer. Chem. Soc., 60, 309, 1938). The increase of the total internal film surface during the first stage of elongation is due to destruction of the orderly and therefore especially dense structure of the isotropic sample formed during film formation. The data presented illustrate that the closely packed, orderly structure changes to a loosely packed and less orderly structure during this process (the specific surface increases nearly by a factor of 6). Further elongation leads to a renewed increase of the packing density of the

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Orderly precrystalline ...

23760  
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B110/B216

molecules. The specific surface of a maximally elongated film is ~2.5 times larger than the degree of order of the new orderly structure, but somewhat smaller than in the initial film. Fig. 2 represents microphotometric curves of variously treated PETP films. Orientation in the sample produces an order involving much larger elements than the microelements present in the unoriented sample. The density drops during the first stage of elongation and then increases again. Macropores are present in the isotropic amorphous film. The density of PETP samples elongated 450% is higher than that of the initial film, owing to orienting "healing" of pores. This healing which sets in at the very outset of elongation explains the relatively small differences in the density values, as compared to the values for the total surfaces. Healing has no influence on the total surface, since the latter is determined by the presence of closely packed structural microformations. The change in birefringence (table) shows that the destruction of the precrystalline structure is due to changes in the position, characteristic of the initial structure, of the elements. This is confirmed by the diffraction pattern of the elongated sample. The increase of flexibility must lead to crystallization, i. e., to long-range order of the molecule centers, to orientation of the side

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23760

Orderly precrystalline ...

S/190/61/003/006/001/019  
B110/B216

groups and to turbidity of the sample. Accordingly, the acetone-treated sample gave the well-defined diffraction pattern shown in Fig. 2. At higher temperatures, the increased flexibility of the molecular chains facilitates the occurrence of relaxation processes. The latter enable the formation of precrystalline structures and, finally, the crystallization with formation of spherulites. There are 2 figures, 1 table, and 13 references: 10 Soviet-bloc and 3 non-Soviet-bloc. The reference to the English-language publication reads as follows: Ref 13: A. B. Thompson, D. W. Wood, Nature, 176, 78, 1955.

ASSOCIATION: Vsesoyuznyy nauchno-issledovatel'skiy kino-fotoinstitut (All Union Scientific Research Cinematography and Photography Institute). Fiziko - Khimicheskiy institut im L. Ya. Karpova (Physical Chemical Institute imeni L. Ya. Karpov) - Nauchno-issledovatel'skiy institut shinnoy promyshlennosti (Scientific Research Institute for Tire Industry)

SUBMITTED: February 25, 1960

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23773

5,3830

1209 1234 1372

S/190/61/003/006/016/019  
B110/B208

AUTHORS: Pshezhetskiy, V. S., Kargin, V. A., Bakh, N. A.

TITLE: Polymerization of acetaldehyde in the condensed phase under the action of X-rays

PERIODICAL: Vysokomolekulyarnyye soyedineniya, v. 3, no. 6, 1961, 925 - 930

TEXT: According to M. Maga et al. (Ref. 1: Simpozium po makromolekulyarnoy khimii, Moskva, June, 1960. Khimiya i tekhnologiya polimerov, No. 7 - 8, 102, 1960) polymerization in the solid phase takes place at low temperatures under the action of ionizing radiation. V. A. Kargin, V. A. Kabanov and V. P. Zucov (Ref. 8: Vysokomolek. soyed., 265, 1959) observed a transition from the amorphous into the crystalline state in the polymerization. According to N. N. Semenov (Ref. 9: Simpozium po makromolekulyarnoy khimii, Moskva, June, 1960. Khimiya i tekhnologiya polimerov, No. 7 - 8, 196, 1960) the crystal lattice causes a special polymerization mechanism. The authors studied the acetaldehyde polymerization by means of X-rays in the solid phase. The acetaldehyde fraction (boiling

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Polymerization of acetaldehyde...

S/190/51/003/006/016/019  
B:10/B208

point 20.1 - 20.4°C/760 mm and  $n_D^{20} = 1.34$  was allowed to solidify in 10-ml ampuls filled with  $N_2$  (residual pressure  $10^{-4}$  mm) for 30 sec. The sample was irradiated with the BXB (VKhV) X-ray tube with ~60 kV and 100 ma at the temperature of liquid nitrogen as well as at different temperatures in the cryostat. The absorption energy was determined on the ferrous sulfate dosimeter. The polymerizate was dissolved in acetone with 1 % inhibitor (naphthylamine); precipitated in water; the molecular weights were determined viscosimetrically in methyl ethyl ketone at 17.8°C according to:  $[\eta] = 5.36 \cdot 10^{-4} M^{0.65}$ . The absence of the increase of the conversion degree (Fig. 1) as well as the decrease of molecular weight with increasing integral radiation dose are indicative of destruction processes in addition to polymerization. In order to explain the influence of the physical conditions of the phase upon the polymerization the monomer was cooled down under different conditions. Quick cooling for 1 min gave a transparent amorphous monomer. Slow cooling of the liquid and cooling of the vapors gave monomers with different degrees of crystallinity. Irradiation was made at different temperatures. As, according to Table 2, the degree of monomer conversion and the polymer

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B110/B208

Polymerization of acetaldehyde...

molecular weight are directly proportional to the degree of crystallinity, acetaldehyde is polymerized by X-rays in the crystalline phase. Polymerization takes place according to G. Moravtsev (Ref. 4: Khimiya i tekhnologiya polimerov, No. 10, 23, 1959) as radical mechanism polymerization (I), similarly as in the liquid phase or by radical migration in the crystal lattice (II) or according to N. N. Semenov (Ref. 9: Simpozium po makromolekulyarnoy khimii, Moskva, June, 1960. Khimiya i tekhnologiya polimerov, No. 7 - 8, 196, 1960). In the case of (I) the radical acceptors are said to have a negative effect on polymerization, and a difference should exist between these and substances with similar configuration, which, however, do not accept radicals. In (II), this difference is not assumed to exist. The authors determined yield and molecular weight on incorporation of various admixtures into acetaldehyde. All admixtures having nearly the same effect on the degree of conversion, this must be due to fracture of the crystal lattice. The latter had to be the greater, the larger the geometric molecular dimensions are. The effect observed is due to the formation of some defect in the crystal lattice. Polymerization thus takes place in the solid phase, otherwise the effect of the admixtures would not be so homogeneous and intense

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B:10/B208

Polymerization of acetaldehyde...

The results obtained indicate a polymerization in the solid phase due to properties of the crystal lattice. The number of the ion pairs formed may be estimated from the absorbed radiant energy, and compared with the number of molecular chains calculated from the molecular weights. If the formation of an ion pair gives rise to the formation of a reaction chain, the ionizing energy absorbed will be 30 e.v. At a total absorbed energy of  $10^{19}$  erg/cm<sup>3</sup>,  $3.3 \cdot 10^{17}$  reaction chains appear per cm<sup>3</sup>. For  $M = 600,000$ ;  $P_n = 13,300$ , conversion degree 35.2%; initial monomer = 7.8 g the total number of molecules per cm<sup>3</sup> was:  $n = 3.66 \cdot 10^{23}$ , and the mean number of molecular chains:  $n/P = 2.7 \cdot 10^{17}$ . The latter corresponds to the number of ion pairs. A reaction chain is thus formed during the formation of each ion pair. The authors conclude from their thermodynamic data and thermographic measurements that this polymerization mechanism is no radical mechanism. Temperature change from -195°C to -182°C does not affect the reaction rate. Slight increase of the conversion degree is due to increasing molecule mobility. When, however, the melting point is passed, the conversion degree decreases abruptly. The activation energy is 0.45 kcal/mole. The authors conclude from all results that the polymeri-  
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Polymerization of acetaldehyde...

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zation of acetaldehyde in the solid phase takes place by means of expansion on the crystal lattice.

There are 2 figures, 4 tables, and 11 references: 4 Soviet-bloc and 7 non-Soviet-bloc. The three most recent references to English-language publications read as follows: E. J. Lawton; W. T. Grubb; J. S. Balwit, J. Polymer Sci., 19, 455, 1956. Ref. 6: G. Adler: J. Chem. Phys., 31, 848, 1959. Ref. 7: B. Baysal, G. Adler, D. Ballantine, P. Colombo. J. Polymer Sci., 44, 117, 1960.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova  
(Moscow State University imeni M. V. Lomonosov)

SUBMITTED: November 4, 1960

Card 5/8

KARGIN, V.A.; PLATE, N.A.; LITVINOV, I.A.; SHIBAYEV, V.P.; LUR'YE, Ye.G.

Processes of polymerization and grafting on newly formed surfaces  
of inorganic substances, Vysokom.soed. 3 no.7:1091-1099 J1 '61.  
(MIRA 14:6)

1. Moskovskiy gosudarstvennyy universitet imeni M.V.Lomonosova.  
(Polymerization)



KARGIN, V.A.; BAKYEV, N.F.; LI LI-SHEN

Polytrifluorochloroethylene single crystals. Vysokom.sped. 3 no.7:  
1100-1101 J1 '61. (MIRA 14:6)

1. Moskovskiy gosudarstvennyy universitet imeni M.V.Lomonosova.  
(Ethylene) (Crystals)

5.3100  
15.8500

25275

S/190/61/003/007/017/021  
B101/B230

AUTHORS: Li Li-sheng, Kargin, V. A.

TITLE: Examination of the microscopic structure of crystalline polymers in large blocks

PERIODICAL: Vysokomolekulyarnyye soyedineniya, v. 3, no. 7, 1961, 1102 - 1103

TEXT: Contrary to investigations hitherto cited in publications, in the present paper structures were not examined in solutions or films but in blocks of high-pressure and low-pressure polyethylene, isotactic polypropylene, and polycaprolactam. The polymers were previously hardened or annealed, their microscopic sections were etched and examined with an MIM-7 (MIM-7) type microscope. Polyethylene and polypropylene were etched by applying hot benzene vapor. Etching figures were observed similar to those characteristic of etched metal surfaces: isolated patterns with clear-cut regular contours. Hardening caused an increase in fine-grained structure. On annealed low-pressure polyethylene, geometric patterns were more distinctly marked. individual patterns

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Examination of the microscopic. . . 25173

S/190/61/003/007/017/021  
B101/B230

attained lengths up to 20. Similar etching figures were obtained for polypropylene. Polycaprolactam was etched with diluted acetic acid. Structures observed allowed to conclude on spherulites. Authors agreed to assume that the structure of crystalline polymer blocks is closely similar to the structure of metals. There 2 figures and 1 non-Soviet-bloc reference. The reference to English-language publication reads as follows: F. O. Reding, E. R. Waite, J. Polymer Sci., 38, 141, 1959.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomono-  
sova (Moscow State University imeni M. V. Lomonosov)

SUBMITTED: December 2, 1960

Card 2/2

15-8520

26300

S/190/61/003/008/013/019

B110/B208

AUTHORS: Li, Li-sheng, Andreyeva, N. S., Kargin, V. A.

TITLE: X ray examination of polyethylene monocrystals at different temperatures

PERIODICAL: Vysokomolekulyarnyye soyedineniya, v. 3, no. 8, 1961, 1236-1242

TEXT: The particularities of elastic vibrations of crystal lattices of isolated polyethylene (PE) crystals could be clarified by measuring the thermal expansion coefficients of the three parameters of the rhombic unit cell of PE which consists of several monocrystals. The purpose of the present paper was the determination of the thermal expansion coefficients of PE monocrystals in the temperature range from -50 to +135°C. PE monocrystals were obtained from 0.01% solution in xylene, by heating at 140°C and cooling down to room temperature for three weeks. X ray pictures were taken by means of PKBT-400 (PKVT 400) chamber. Temperature was kept constant and recorded by thermocouples connected in series and by an ЭПД-17 (EPD-17) electron potentiometer. Cu K $\alpha$  rays obtained by Ni filter were used. The Debye crystallograms were taken and the cell parameters a and Card 1/4

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B110/B208

X-ray examination of...

b determined. The parameter along the c axis could not be determined since the (000) reflex was masked by a group of lines. The spread of a on the basis of the (200) line was  $\pm 0.02 \text{ \AA}$ , on the basis of the (400) line  $\pm 0.01 \text{ \AA}$ . The parameters b were determined from the (020) line maximum error  $\pm 0.01 \text{ \AA}$ . Results were well reproducible. They are as follows:

T °C	18.5	40	50	70	75	97	100.5	105	110	115	119
a (Å)	7.40	7.43	7.45	7.50	7.51	7.55	7.58	7.64	7.70	7.72	7.75

b (Å) 4.94

The linear expansion coefficient  $\alpha_b$  in the range 18.5 - 119°C is zero.

The following was found for  $\alpha_a$  between 18.5 - 97°C:  $\alpha_a = 2.6 \cdot 10^{-2} \%/^\circ\text{C}$

$\pm 0.8 \cdot 10^{-2} \%/^\circ\text{C}$ ; between 97 - 120°C:  $\alpha_a = 1.2 \cdot 10^{-2} \%/^\circ\text{C}$ . The curves

$a = f(T)$  and  $b = f(T)$  in the low-temperature range were recorded by cooling the samples in liquid  $N_2$ . This was performed by a closed PKB-86 (RKV-86) chamber. The following  $\lambda$  values were found: T = 18.5°C: a = 7.40; b = 4.94. T = 47°C: a = 7.22; b = 4.86. In the temperature range of -47°C to 18.5°C,  $\alpha_a = 3.6 \cdot 10^{-2} \%/^\circ\text{C} \pm 0.9 \cdot 10^{-2} \%/^\circ\text{C}$ ;  $\alpha_b = 2.4 \cdot 10^{-2} \%/^\circ\text{C}$

$\pm 0.7 \cdot 10^{-2} \%/^\circ\text{C}$ . The root mean square deviation of the lattice points of

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X-ray examination of...

the PE cell was estimated for the lines (200) and (400) with temperature fluctuations. A temperature dependence of the integral intensity of the

Debye line was assumed corresponding to:  $\exp(-2ku_g^2 \sin^2 \theta / \lambda^2)$ , where k is

a constant,  $u_g^2$  the root mean square deviation at the temperature T. The following was found:

T°C	sin $\theta_{200}$	sin $\theta_{400}$	I <sub>200</sub>	I <sub>400</sub>
-47 (T <sub>2</sub> )	0.2130	0.4271	71	11.9
18.5 (T <sub>1</sub> )	0.2079	0.4078	73.8	7.55

The root mean square deviation of the lattice points was 0.06 Å<sup>2</sup> between 18.5 and -47.5°C 0.06 Å<sup>2</sup>. The data obtained were in good agreement with those obtained by D. R. Holmes, C. W. Bunn, and W. P. Slichter. The divergent data obtained by T. H. Wakelin et al. are explained by the fact that they are mean values for wide temperature ranges. The different character of the change of  $\alpha_a$  and  $\alpha_b$  is explained by the fact that the

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X-ray examination of...

rotary motions are not yet effective at low temperatures (A. I. Kitaygorodskiy, Organicheskaya kristalloghimiya, 1955). On the basis of papers by A. Keller on the laminated structure of monocrystals the authors assume: (1) at 100°C, an intermediate stage of decomposition begins; decomposition into bands; (2) decomposition takes place step by step, and is completed at the melting point (135°C). The intense increase of the one cell parameter is caused by the secondary structure of crystals. Keller's assumption saying that the bands are located in the (110) plane are not confirmed by the authors' experimental data and by the sliding of bands along (010). The bands lie in the (100) plane. There are 3 figures and 15 references: 3 Soviet-bloc and 12 non-Soviet-bloc. The three most recent references to English-language publications read as follows: Ref. 3: D. R. Holmes, J. Polymer Sci., 42, 237, 1960; Ref. 4: T. H. Wakelin, A. Sutherland; R. L. Beck, J. Polym. Sci., 42, 278, 1960; Ref. 13: A. Keller, O' Connor, Disc. Faraday Soc., 1958, N 25, 114.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova (Moscow State University imeni M. V. Lomonosov)

SUBMITTED: December 2, 1960

Card 4/4

15.8060

26303

S/190/61/003/008/016/019

B110/B208

AUTHORS: Konstantin Gol'skaya, M. B., Berestneva, Z. Ya., Kargin, V.A.

TITLE: Spiral structures of polyethylene. II

PERIODICAL: Vysokomolekulyarnyye soyedineniya, v. 3, no. 8, 1961,  
1260 - 1264

TEXT: In a previous paper by the authors (Ref. 1: Vysokomolekulyar. soyed., 2, 1715, 1960) low-pressure polyethylene was shown to form spiral structures under certain conditions. In the present paper they studied various modifications of PE with respect to spiral structure. Low-pressure PE, high-pressure PE, and radiation PE were used. Xylene solutions of PE (0.1 and 0.01%) were prepared and the boiling solution was applied to colloxylin bases heated to 100 - 110°C. The study was carried out by means of a УЭМБ-10 (UEMB-10) electron microscope. [Abstracter's note: the electron microscope photographs are not reproducible.] The following was found: (1) Some parallel spirals appear with low-pressure PE. (2) When the solution was diluted, spherulite crystals were observed in addition to spirals. (3) Laminae appear in addition to spirals. (4)

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Spiral structures of...

Stretching of the crystals gives rise to filamentous structure. (5) High-pressure PE and radiation PE show a different structure as compared with low-pressure PE: (a) distinctly pronounced spherulites, (b) band structure, which may either appear separately or in spherulite form. A paper by P. V. Kozlov, N. F. Bakeyev, Li P'ang- T'ung, A. S. Kaftanova (Ref. 2: Vysokomolek. soyed., 2, 421, 1960) is mentioned. The authors thank A. D. Abkin, P. M. Khomikovskiy, and N. V. Makletsova for the supply of radiation PE. There are 12 figures and 2 Soviet references.

ASSOCIATION: Fiziko-khimicheskiy institut im. L. Ya. Karpova  
(Physicochemical Institute imeni L. Ya. Karpov)

SUBMITTED: December 23, 1960

Card 2/2

KARGIN, V.A., akademik; MARKOVA, G.S., kand.khimicheskikh nauk

Electron microscope method for investigating polymers. Zhur.VKHO 6  
no.4:362-369 '61. (MIRA 14:7)  
(Polymers) (Photomicrography)



S/078/61/006/005/001/015  
B121/B208

AUTHORS: Kargin, V. A., Lastovskiy, R. P., Matveyeva, T. A.,  
Ryabchikov, D. I., Zarinskiy, V. A., and Farafonov, M. M.

TITLE: Purification of titanium dioxide and meta-titanic acid by the  
method of high-voltage electrodialysis

PERIODICAL: Zhurnal neorganicheskoy khimii, v. 6, no. 5, 1961, 1017 - 1019

TEXT: A method of purifying titanium dioxide and meta-titanic acid by high-voltage electrodialysis was devised. The laboratory set-up consists of a d-c source (capacity 5 - 5.7 KW), an electrodialyzer with five chambers of organic glass and control equipments for measuring amperage and voltage. The electrode spacing is 10 - 12 cm. The titanium dioxide to be purified is put into the central chamber of the electrodialyzer in the form of a suspension. Purification from the impurities Mg, Fe, Al, Ca, Sb, Pb, Sn, Cd, Bi, and Cu is carried out in an ionic current of  $\text{Cl}^-$  and  $\text{NO}_3^-$  at maximum electrode potential. To remove  $\text{SiO}_2$  from titanium dioxide, a dilute KOH solution is added in the anode chamber of the dialyzer, ✓

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Purification of titanium ...

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which reduces the  $\text{SiO}_2$  content from 0,3 to 0,03 %. Traces of Hf, Nb, and Ta are separated from  $\text{TiO}_2$  by conversion to oxalate complexes. Purification was examined by means of the quartz spectrographs of the  $\text{MCT-22}$  (ISP-22) or  $\text{MCT-28}$  (ISP-28)-type. The spectrographic method for the determination of Nb, Ta, Hf, and Cr is precisely described. Titanium dioxide purified by high-voltage electrodialysis, and meta-titanic acid have the following contents of impurities: Zr, Hf, Nb, Ta less than  $1 \cdot 10^{-2}$  %, Mg -  $5 \cdot 10^{-4}$  %, Si -  $1 \cdot 10^{-3}$  %, Fe - less than  $1 \cdot 10^{-4}$  %, Al -  $3 \cdot 10^{-3}$  %, Ca - less than  $1 \cdot 10^{-4}$  %, Sb - less than  $1 \cdot 10^{-4}$  %, P - less than  $1 \cdot 10^{-3}$  %, Cu - less than  $1 \cdot 10^{-4}$  %, Sn - less than  $1 \cdot 10^{-4}$  %, Cd - less than  $1 \cdot 10^{-4}$  %, Pb - less than  $1 \cdot 10^{-4}$  %. There are 4 tables and 6 references: 5 Soviet-bloc and 1 non-Soviet-bloc.

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Purification of titanium ...

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B121/B208

ASSOCIATION: Institut chistykh khimicheskikh reaktivov  
(Institute of Pure Chemical Reagents)  
Institut geokhimii i analiticheskoy khimii im. V. I.  
Vernadskogo Akademii nauk SSSR  
(Institute of Geochemistry and Analytical Chemistry imeni  
V. I. Vernadskiy of the Academy of Sciences USSR)

SUBMITTED: March 17, 1960

Card 3/3

KARGHIN, V. A., acad. [Kargin, V. A.]; ROHLIN, M. I. [Rokhlin, M. I.]

Development of the science of polymers. On the results of the International Symposium on Macromolecular Chemistry of Moscow, June 14-18, 1960. Analele chimie 16 no.1:175-180 Ja-Mr '61. (EEAI 10:9)

(International Union of Pure and Applied Chemistry)  
(Macromolecular compounds)

S/069/61/023/002/008/008  
B101/B208

AUTHORS: Doradkin, B. A., Kargin, V. A., Meyerson, S. I., Rogovin, Z. A.

TITLE: In Memory of Sergey Mikhaylovich Lipatov (Deceased)

PERIODICAL: Kolloidnyy zhurnal, v. 23, no. 2, 1961, 238-239

TEXT: This article is devoted to S. M. Lipatov, an expert in the field of colloid chemistry and physical chemistry of polymers, who died on January 8, 1961. At various institutes he organized laboratories for high-molecular compounds. In particular, he established the laboratoriya iskusstvennogo volokna im. Nauchno-issledovatel'skiy institut im. Karpova (Laboratory of Synthetic Fibers of the Scientific Research Institute imeni Karpov), now the Vsesoyuznyy nauchno-issledovatel'skiy institut iskusstvennogo volokna (All-Union Scientific Research Institute of Synthetic Fibers). In the Soviet Union, Lipatov was the first to lecture on high-molecular compounds and the physical chemistry of dyeing. He was a university teacher for 30 years. Mention is made of his monographs "Fiziko-khimicheskiye osnovy krasheniya" ("Physico-chemical basis of dyeing") (1929); "Vysokomolekulyarnyya  
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S/069/61/023/002/008/008  
B101/B208

In Memory ...

soyedineniya" (High-molecular compounds) (1934 and 1943), "Problemy ucheniya o vysokopolimerakh" (Problems of high-polymer research) (1941). Lipatov took part in conferences on colloid chemistry, and was for many years a member of the editorial board of "Kolloidnyy zhurnal" and of the nauchno-tehnicheskii sovet Ministerstva pishchevoy promyshlennosti (Scientific and Technical Council of the Ministry of Food Industry). Considerable organizing work was done by Lipatov at the Akademiya nauk BSSR (Academy of Sciences BSSR) as Academician and Vice President. There is 1 figure.

Card 2/2

KARGIN, V.A., akademik

Chemists will create a complete range of useful polymers.

Tekh.mol. 29 no.9:14 '61.

(Polymers)

(MIRA 14:10)

15-8600 1209, 1372 1043

2281,8

S/030/61/000/004/001/015  
B105/B206

AUTHOR: Kargin, V. A., Academician

TITLE: Structure of polymers

PERIODICAL: Vestnik Akademii nauk SSSR, <sup>31</sup>no. 4, 1961, 19-26

TEXT: V. A. Kargin delivered this lecture at the annual meeting of the Akademiya nauk SSSR (Academy of Sciences USSR) on February 3, 1961. After a short description of the history of polymer crystallization, at the investigation of which the Fiziko-khimicheskiy institut im. L. Ya. Karpova (Physicochemical Institute imeni L. Ya. Karpov) participated 20 years ago, the author mentioned the results of studies by the Moskovskiy universitet (Moscow University), the Physicochemical Institute imeni L. Ya. Karpov and the Institut neftekhimicheskogo sinteza Akademii nauk SSSR (Institute of Petrochemical Synthesis AS USSR). The following structures are also mentioned in brief: 1) Molecules of poly-acrylic acid; 2) molecules of the sodium salt of poly-acrylic acid; 3) molecular bundles of polysalvarsan; 4) ditto, under other conditions; 5) molecular bundles of polyacrylamide;

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Structure of polymers

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B105/B206

representing organic glass, in liquids so-called clusters are formed; 6) polyethylene pyramidal crystals; 7) ditto, plate-like crystals; 8) round spherical molecules, a globule of polyethylene; 9) crystalline bundles of polyethylene; 10) planes, one on top of the other form at increased concentration of the molecules; 11) so-called spherulites, representing a disordered accumulation of planes; 12) individual slices of polyethylene; 13) spiral structures; 14) highly organized structures of polyethylene from spiral formations; 15) polypropylene, as investigated in the Institute of Petrochemical Synthesis; 16) well shaped crystals of polypropylene; 17) snowflake-like crystals; 18) crystals of monochlorotrifluoro ethylene; 19) crystals of asymmetric length, from which polyacrylic acid can be produced; the author and G. M. Frank intend to study the whole range of crystalline polyacrylates, in order to get at the problem of biological simulation; 20) for a number of polyester., formed by glycols and dicarboxylic acid of the aliphatic series, individual crystals were prepared by Yu. V. Mnyukh at the Institut elementoorganicheskikh soyedineniy Akademii nauk SSSR (Institute of Elemental-organic Compounds of the AS USSR); 21) crystals of the isotactic polystyrene;

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Structure of polymers

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B105/B206

22) ditto of a different type; 23) polystyrene, synthesized for the first time at Moscow University; 24) spherulites representing an intermediate state of structure formation and produced in specially great sizes at Moscow University; 25) spherulites of one of the polyesters, which can be etched like metals; 26) elements of the planes, wrapped together into broad spirals, develop during further etching; 27) hardened polyethylenes; 28) glowed polyethylene; the development of coarse spherulite formations studied by A.V. Yermolina at the Nauchno-issledovatel'skiy institut plastmass Gosudarstvennogo komiteta Sovieta Ministrov SSSR po khimii (Scientific Research Institute of Plastics of the State Committee for Chemistry of the Council of Ministers USSR) is also observed for polyamides; 29) hardened polyamides; 30) glowed polyamides; 31) formation of great spherulites as a result of recrystallization; 32) film with uniaxial orientation; 33) film with transverse orientation; 34) structure of gelatins. The author mentions the experiment of producing and observing structures in proteins. Recordings of gelatin structures are to prove that an attempt at modeling of biological structures may be feasible. The author finally expresses his conviction that the study of structural

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Structure of polymers

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B105/B206

processes in polymeric systems offers new possibilities in the fields of the practical change of mechanical properties of polymeric substances and biological modeling. [Abstracter's note: The photos are not reproducible.] There are 35 figures. X

Card 4/4

KARGIN, V.A., akademik; ROKHLIN, M.I.

Problems in working plastics. Vest.AN SSSR 31 no.5:89-93 My '61.

(MIRA 14:6)

(Plastic industry)

S/026/61/000/010/001/011  
D035/D113

AUTHORS: Kargin, V.A., Academician; Rokhlin, M.I.

TITLE: Polymers in 1990

PERIODICAL: Priroda, <sup>52</sup>no.10, 1961, 38-48

TEXT: The authors review the development in polymer production during the last 25-30 years, indicate new trends in the synthesis of these materials and, discussing the qualitative improvements necessary for their universal application, roughly evaluate the importance of polymers during the next 20-30 years. The increase is due more to the development of new polymers than to increased production of already known materials. Academician N.N. Semenov remarked that due to the development of polymers, man is no longer limited to the use of natural substances. Reviewing the most important polymer products, the authors underline that synthetic rubbers, particularly those with regular polyisoprene- or polybutadiene-based chains, are in some respects, even superior to natural rubber. Progress in synthetic fiber production is characterized by the transition from natural high-molecular compounds as starting materials to synthetic fiber-producing polymers.

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Polymers in 1990

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D035/D113

as caprone, nylon, the polymers and copolymers of acrylic acid nitrile, etc. Synthetic fibers not only qualitatively compete with natural silk and wool, but the production costs of these materials are also 2-3 times lower. The production of synthetic leather and furs is also being developed. Synthetic glues have been widely adopted for glueing plywood, in the shoe industry etc. They are now also being used in bridge construction. Films of polyvinyl chloride, polystyrene, etc., and in recent years films of polyethylene and polypropylene have been used as electroinsulators and on a still larger scale as packing materials. Ion-exchanging resins, i.e. high-molecular compounds capable of exchanging active ions for ions of dissolved electrolytes, are widely applied for purifying substances, separating precious metals, etc. The authors review the most important types of plastic materials. Improved plastics were developed for use in construction engineering, electrical and radio engineering, etc. Fluoroplastics, organosilicon resins and plastics have high thermal resistance. Reinforced plastics, particularly glass plastics i.e. a composition of synthetic binders of the unsaturated polyester resin type and glass-fiber fillers exhibit great strength. Polystyrene, polyethylene terephthalate and organo-silicon compounds show good electroinsulating properties. Foam and porous plastics with a volumetric

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Polymers in 1990

S/026/61/000/010/003/004  
D035/D113

weight as low as  $0.01 \text{ kg/m}^3$  meet the special needs of the aircraft, ship-building, RR car building and automobile industries. Organic glass mostly obtained from polymerization products of methyl ester of metacrylic acid is now widely used. This glass is light, strong, permeable to ultraviolet rays and has good machinability. The authors further discuss previous and more recent methods of processing ethylene and the plastics derived from it. Epoxy resins and wood plastics impregnated with synthetic resins are also very important. With respect to the behavior of plastics during shaping, the authors distinguish two classes: (1) Thermoreactive plastics which become infusible and insoluble in the mold under heat and pressure, and thus cannot be reshaped further; (2) thermoplastics, i.e. plastics which can be softened by heat and thus reshaped many times. Plastics of the first class are based, for instance, on synthetic phenol-formaldehyde and amino-formaldehyde resins. Thermoplastics are represented by polyvinyl chloride, polyethylene, polystyrene, etc. During the last thirty years, the proportion of thermoplastics in plastics production has steadily been increasing. The authors discuss the development of copolymers, graft polymers and block-copolymers, in which individual properties of various polymers are combined in one new material. Recently, new polymerization methods made it possible to

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Polymers in 1990

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obtain polymers with a regular molecular structure and a definite alternation of the links. This so-called stereospecific process gave good results. Stereo-regular polypropylene, for instance, shows high thermal resistance. One of the most important future trends in the development of polymers will be to increase their strength, i.e. maximum resistance to shock, bending, friction, etc. It is probable that in the near future chemical fibers whose specific strength exceeds that of steel in weight and volume, will be developed. The authors discuss two main methods by which the strength of polymers will be increased. The first consists in changing their macromolecular structure without changing their chemical composition whilst the second consists in improving reinforced systems and creating variously combined construction materials. Structural synthesis, reinforcement, processing methods not affecting the strength, and new types of binders and gluing substances will all help to make new types of strong light-weight ships, planes, machines, automobiles, houses, etc. The maximum thermal resistance of polymers presently used (250-350°C) can be raised by introducing links with inorganic components into the chain of the polymer molecule. However, really high thermal resistance (600-1000°C) can only be expected from polymers with an exclusively inorganic chain. However, as inorganic

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Polymers in 1990

S/026/61/000/010/003/004  
D035/L113

polymers are brittle, their future use depends on the possibility of obtaining elastic products of the synthetic-asbestos type which may be used for the construction of rockets, space vehicles, etc. As high-molecular compounds, in particular those with conjugated bonds, have good semi-conductive properties, it may be possible in the future to obtain semiconductors in the form of fabrics, films, elastics, etc. The authors consider that formaldehyde, which can be obtained directly from natural gas, will be the most widely produced plastic. The difference between plastics and rubber will decrease, and methods will be found for producing articles from infusible and insoluble plastics which are now unworkable. The development of the production of polyisoprene, polybutadiene, elastomers based on polyolefines and polyurethanes and the synthesis of heat-proof elastomers containing boron, phosphorus, etc., will increase the variety of synthetic rubbers in the next decades. The search for elastomers in saturated compounds will make it possible to eliminate their basic shortcomings such as high oxidability and sensitivity to light. Tires will become more durable and cheaper. The present complicated method of producing rubber items will possibly be replaced by methods of precision casting. The authors consider that synthetic fibers will eventually replace natural raw materials, except cotton, which,

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Polymers in 1990

S/026/61/000/010/003/001  
D035/D113

however, will only be used in a chemically improved form. Porous materials will be used for clothing. Materials for lacquer coatings top the list in polymer production. The authors assume that in the next decades coatings for metals will be based entirely on water-soluble synthetic binders and water-diluted emulsions. The authors underline the growing importance of polymers for construction engineering, machines, agriculture, transport and equipment for space ships. Household items will be largely made of polymers. Polymers will also play an important role in medicine, biology, hygiene (purification of water), and photography. There are 5 figures. ✓

Card 6/6

KARGIN, V.A., akademik; KABANOV, V.A.; ZUBOV, V.P.; ZEIN, A.B.

Polymerization of acetonitrile and other nitriles. Dokl. AN SSSR  
139 no.3:605-607 J1 '61. (MIRA 14:7)

1. Moskovskiy gosudarstvennyy universitet im. M.V. Lomonosova.  
(Nitrile) (Polymerization)

25854

S/020/61/139/004/014/025

B103/B206

2209.1372  
AUTHORS: Kargin, V. A., Academician, and Andrianova, G. P.

TITLE: Formation of large microscopic structures in crystalline polypropylene

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 139, no. 4, 1961, 874 - 876

TEXT: The authors studied the microscopic structures of isotactic polypropylene (molecular weight about 100,000), which are formed from the melt of the polymer during slow cooling (0.07 deg/min). The melt was cooled to a required temperature and kept at this temperature for 6 hr. The authors investigated the surface of a brittle fracture which is formed during impact deformation at the temperature of liquid nitrogen. A metallographic microscope of the type MIM-8M (MIM-8M) was used. Most publications so far concern either thin films or dilute solutions, in which such structures can only be formed incompletely. The authors proved that the crystallization of isotactic polypropylene in the condensed phase may proceed up to the formation of very big spherulites (40 - 200  $\mu$ ) and even crystals (over 200  $\mu$ ). Size and character of the structural elements of the spherulites change

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25851  
S/C20/61/139/004/014/025  
B103/B206

Formation of large microscopic ...

with the crystallization temperature. The authors are certain that the properties of the polymeric substance are greatly affected by such crystalline structures. The spherulites are spherically symmetric and have distinct interfaces. In the authors' opinion, a quick formation of such perfect crystalline structures is inconceivable, if the polymeric melt is regarded as a system of irregularly entangled chains. They believe that the molecular chains have already been arranged in the melt. Thus, only a certain completion of this arrangement, which ends with the formation of the crystalline phase, seems to occur during the relatively short cooling time. The formation of such big spherulites under the prevailing high viscosity and the low mobility of the chains are taken as further proof of the packet theory of polymeric substances by V. A. Kargin, A. I. Kitaygorodskiy, and G. L. Slonimskiy (Ref. 7: Koll. zhurn., 19, 131 (1957)). According to this theory, polymers in crystalline and even amorphous state are considered to be well ordered systems, built up either from globules or unfolded chains which are comprised into packets (V. A. Kargin, N. F. Bakeyev, Ref. 8: Koll. zhurn., 19, 133 (1957)). Crystallization starts within a packet, while the formation of a crystalline structure is the last stage of the arrangement of the chains. The most perfect crystalline form are single

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S/020/61/139/004/014/025  
B103/B206

Formation of large microscopic ...

crystals. In most cases, however, crystallization does not reach this stage but comes to a standstill in the stage of forming less perfect, secondary structural spherulites. This is more favorable from the kinetic point of view, since it requires only a minimum rearrangement of the little mobile structure of the crystalline polymer. The authors will discuss the results of the study of monocrystals in a special paper. The crystals were regularly faceted and showed no radial symmetry. The authors established the following rules for the temperature effect on the structure of spherulites: 1) At a crystallization temperature between 130 and 140°C, spherulites of a size of 40 - 100  $\mu$  are formed. At about 100°C their diameter reaches 160 - 220  $\mu$ . 2) Spherulites formed above 100°C have a lamellar structure; at temperatures below 100°C, their structural elements become fibriform, until the spherulites degenerate to a system of entangled fibrils. The character of destruction of a polymeric substance is strongly affected by its crystalline structure. For a brittle fracture of a polymeric block consisting of large structures, destruction possibly occurs along the boundaries of the crystal grains. Specimens with big spherulites (about 200  $\mu$ ) are much more easily destroyed than those consisting of small crystals. In many cases, impact deformation also leads to a

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25854

S/020/61/139/004/014/025  
B103/B206

Formation of large microscopic ...

destruction of the spherulites themselves, the lamellar character of their structure being disclosed. There are 3 figures, and 8 references: 4 Soviet-bloc and 4 non-Soviet-bloc. The three references to English-language publications read as follows: E. H. Andrews (Ref. 1: J. Polym. Sci., 33, 39 (1958); C. V. Bunn et al. (Ref. 2: *ibid.* 28, 365 (1958); F. P. Redding, E. R. Walter (Ref. 3: *ibid.* 38, 141 (1959)).

ASSOCIATION: Institut neftekhimicheskogo sinteza Akademii nauk SSSR  
(Institute of Petrochemical Synthesis of the Academy of  
Sciences USSR)

SUBMITTED: April 12, 1961

Card 4/4

15-8050 1273, 1297, 2209  
54800

25717  
S/020/61/139/003/016/025  
B103/B226

AUTHORS: Kargin, V. A., Academician, Kabanov, V. A., Zubov, V. P.,  
and Zevin, A. B.

TITLE: Polymerization of acetonitrile and other nitriles

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 139, no. 5, 1961, 605-607

TEXT: The authors proved the possibility of adding another multiple bond (C≡N) to the bonds undergoing polymerization. This is possible when applying the principle of preliminary ordering of the monomer molecules. Thus, the formation of a new class of polymers having conjugated bonds in the principal chain becomes possible. For this purpose, the authors used nitriles (acetonitrile, propionitrile, tolyl nitrile, benzonitrile, trifluoroacetonitrile, and others). Under standard conditions, polymerization of these compounds on the C≡N bond is not possible, because these bonds should form a C=N- and a C-N bond each. In this case, a heat absorption of about 11 kcal/mole would be caused (M. Kh. Karapet'yants, Ref. 2: Khimicheskaya termodinamika (Chemical thermodynamics), M. 1953), without considering conjugation energy. The latter energy, which is

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Polymerization of acetonitrile and...

released in the formation of the bond system -C=N-C=N-. . . would, at best, cover the deficiency mentioned. In this way, the thermal effect of the reaction would be nearly zero. However, the transition from a liquid monomer to a solid polymer is always accompanied by an entropy decrease ( $\Delta S < 0$ ) (with a change of heat contents  $\Delta H = -Q \approx 0$  and  $\Delta S < 0$  the change of isobaric-isothermal potentials  $\Delta Z = \Delta H - T\Delta S > 0$ ). The authors have ordered the monomer molecules in solid complexes which are readily formed by nitriles with such coordination-unsaturated metal halides as  $ZnCl_2$ ,  $BeCl_2$ ,  $TiCl_4$ ,  $AlCl_3$ ,  $SnCl_4$ . These complexes are crystalline substances of constant composition (usually  $MeX_n \cdot 2RCN$ ). During their formation the entropy of the system is essentially decreased. There is reason to believe that the monomer molecules in these complexes form packings favoring their combination into molecular chains. Heating of these complexes to 180-350°C in hermetically sealed glass ampoules or in the autoclave in the absence of moisture and air oxygen resulted in polymerization of the ordered nitrile molecules with the formation of conjugated

...-C<sup>R</sup>=N-C<sup>R</sup>=N-C<sup>R</sup>=N-... chains. In this process, the metal halide

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Polymerization of acetonitrile and...

plays the part of agents which displace the chemical monomer-polymer equilibrium in favor of the polymer formation. After polymerization the inorganic salt can be washed out by water, ammonia, or acids. Other experiments (heating of nitriles in which only small quantities of the above-mentioned salts are dissolved, 10,000 atm pressure) are unsuccessful, since they lead only to the formation of cyclic trimers. The above-mentioned structural formula of polynitriles is confirmed by data of infrared spectroscopy (Fig. 1). According to the authors' opinion, polymerization proceeds step by step. The molecular weight of the polymer increases with time. The yellow, low-molecular, water-soluble products forming at first gradually become dark brown and black. From the acetonitrile complex with  $ZnCl_2$  heated to 250°C for 5 hr, a dark brown powder is formed, which is soluble in dimethyl formamide. Further heating yields polymers that are soluble only in concentrated (formic, phosphoric, sulfuric) acids. After 10 hr and more, black insoluble polymers are formed. This is confirmed by the increasing viscosity of polymer solutions in  $H_2SO_4$ . Similar relationships can be noted when increasing the reaction temperature. On the assumption that each of the

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B103/B226

Polymerization of acetonitrile and....

polymer chains in the complex increases step by step independently of the other chains, the change of the polymerization degree (P) in time (t) can be written as  $dP/dt = k$  or  $P = kt$ , where, in first approximation, k can be assumed as a constant depending on the temperature and structure of the complex. The intrinsic viscosity is related with P by  $[\eta] = KP^\alpha$ . For very

hard polymers, such as polynitriles,  $\alpha$  is probably  $\sim 2$ . Therefore,

$[\eta] \approx k^2 K t^2 = K t^2$ . In fact, the experimental function  $[\eta]$  of  $t^2$  can be described by a straight line which is extrapolated up to the origin of the coordinates. Polynitriles exhibit a high thermal stability, semi-conductive properties, and the electron paramagnetic resonance spectra characteristic of polyconjugated systems. The electrical conductivity of polymer powders changed within wide limits with good reproducibility on a change of the polymerization temperature. It increases with increasing time and temperature of polymerization. For a temperature increase between 20 and 200°C, conductivity is rigorously changed according to the equation  $\sigma = \sigma_0 e^{-E/RT}$ . The activation energy of electrical conductivity decreases with increasing time and temperature of polymerization between

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Polymerization of acetonitrile and...

25717

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B103/B226

0.35 and 0.2 ev. From the increase in  $\sigma_0$ , the authors conclude that "compensated effects" are absent. There are 3 figures, 1 table, and 5 references: 4 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: H. J. Emeleus, G. S. Rao (Ref. 3: J. Chem. Soc., 1958, 4245).

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova  
(Moscow State University imeni M. V. Lomonosov)

SUBMITTED: May 4, 1961 ..

Card 5/6

S/020/61/139/005/009/021  
B104/B201

AUTHORS: Berestnev, V. A., Razikov, K. Kh., Alekseyeva, Ye. S., and  
Kargin, V. A., Academician

TITLE: Structure of oriented polymers

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 139, no. 5, 1961, 1093-  
1094

TEXT: The structure of polymers includes a so-called supermolecular formation which reaches beyond the molecular dimensions. The authors used an electron microscope to examine this supermolecular formation on thread sections cut by a microtome. Longitudinal and cross sections were prepared, and special care was taken to save the structure from damages in the cutting process. In this process, all threads were found to split into small fibers with diameters ranging between 1 and 10 $\mu$ . The fibers had partly a nonoriented, coarse spherulitic structure, and fine globular formations; others had nonoriented macroformations. The authors base on these results to assume that the structure of chemical threads consists of anisodiametric elements, the fibers. The fibers do not contain any

Card 1/2

Structure of oriented polymers

S/020/61/139/005/009/021  
B104/B201

oriented microstructural elements. The anisotropy of thread properties is evidently caused by the fiber shape. From a micropicture of a fiber (not reproducible) in which there is a hole the authors infer from the fact that this hole is neither circular nor elliptic that there are stress inhomogeneities in the fibers. The results yielded by examinations of fibers by a polarization microscope (400 - 600 - fold magnification) cause the authors to conclude that some fibers lack an orientation of the molecular structure; an orientation of the surface layer of the fiber was established in a number of cases. Thus, the structure of chemical threads appears to consist of fibers having a nonoriented regular macroformation. The anisotropy of a number of properties in these materials is caused by the fibrous structure. There are 4 figures and 3 Soviet references.

ASSOCIATION: Fiziko-khimicheskiy institut im. L. Ya. Karpova  
(Physicochemical Institute imeni L. Ya. Karpov)

SUBMITTED: April 18, 1961

Card 2/2

S/020/61/139/006/016/022  
B103/B101

AUTHORS: Kargin, V. A., Academician, and Gorina, I. I.

TITLE: Polymorphism of crystalline polypropylene

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 139, no. 6, 1961, 1374 ✓

TEXT: The authors studied the various morphological forms of crystalline, stereoregular polypropylene which has a high molecular weight ( $M=100,000$ ).

Its solutions in xylene and decalin (concentration, 0.001 - 0.1%) were heated to 10 - 15°C below the boiling point of the solvent. Subsequently, it was slowly cooled to room temperature within two weeks. The resulting hyaline suspension was applied to a colloxyline backing, preshadowed, and examined under an GEM-5G electron microscope. Electron diffraction of the single crystals shows distinct reflexes which disappear under the action of the electron beam. The beam apparently suppresses the diffractive power of the specimen without changing its form. For the first time the authors observed a polymorphism with such a great variety

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Polymorphism of crystalline polypropylene S/O20/61/139/006/016/022  
B103/B101

of morphological forms of a polymer: the polypropylene specimen showed long rods with a size of up to  $5\mu$ , regular triangles, hexagonal crystals, crystals resembling snow-flakes, body-centered crystals with distinctly marked lateral faces, and also the rhombic structure which is characteristic of polymers. The authors obtained intermediate crystal forms by changing the conditions of crystallization (temperature, concentration, cooling rate). At low concentrations ( $\leq 0.001\%$ ) and at temperatures near the boiling point of the solvent, asymmetric bodies with a size of up to  $0.5\mu$  are formed. In the course of the process, longitudinal crab-shaped, needle-shaped, or dendritic bodies were formed. It is concluded that the Keller mechanism of formation of crystal structures (accumulation of planes) is not the only mechanism underlying the crystallization of polymers. This problem will be discussed by the authors in a later paper. [Abstracter's note: The electron micrographs are not reproducible.] There are 4 figures, 1 Soviet and 7 non-Soviet references. The three most important references to English-language publications read as follows: A. Keller, *Phil. Mag.*, 2, 1171 (1957); B. G. Rånby, F. F. Morehead, N. M. Walter, *J. Polymer Sci.*, 44, 349 (1960); P. H. Geil, *J. Polymer Sci.*, 44, 449 (1960).

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Polymorphism of crystalline polypropylene

S/020/61/139/006/016/022  
B103/B101

ASSOCIATION: Institut neftekhimicheskogo sinteza Akademii nauk SSSR  
(Institute of Petrochemical Synthesis of the Academy of  
Sciences USSR)

SUBMITTED: April 12, 1961

✓

Card 3/3



27878

S/020/61/140/001/015/024  
B103/B101

15.8050

AUTHORS: Kargin, V. A., Academician, Kabanov, V. A., Zubov, V. P.,  
Papisov, I. M., and Kurochkina, G. I.

TITLE: Polycondensation of acetone and other carbonyl-containing  
compounds

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 140, no. 1, 1961, 122-124

TEXT: The authors produced highly stable high-molecular polyvinyls on the basis of ketones and aldehydes (acetone; 1,1',1"-trifluoro acetone; acetophenone; acetaldehyde, and others). These substances were subjected to polycondensation in the presence of comparatively large amounts of dehydrating catalysts such as  $ZnCl_2$ ,  $BeCl_2$ , or  $TiCl_4$  which are capable of forming complex compounds with molecules of monomers. The order of monomer molecules in such complexes permits extensive polycondensation processes. In previous papers, the authors showed (Vysokomolek. soyed., 1, 265 (1959); 1, 1859 (1959); 3, 426 (1961); Internat. Symposium on Macromolecular Chemistry, Section 2, M., 1960, p. 453; V. A. Kabanov, Dissertation for the degree of candidate, M., 1960) that the ordered

Card 1/4

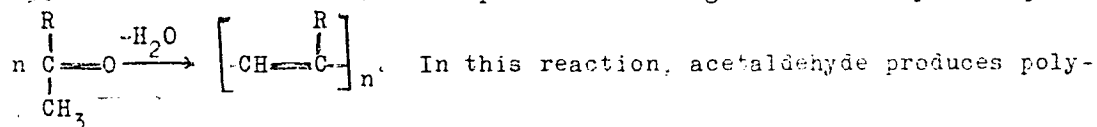
27878

S/020/61/140/001/015/024

B103/B101

Polycondensation of acetone...

position of the monomer molecules may lead to very high, often explosive polymerization rates of solid monomers, even at very low temperatures. S. M. Skuratov's data (A. V. Volekhina, G. I. Kudryavtsev, S. M. Skuratov, A. K. Bonetskaya, Internat. Symposium on Macromolecular Chemistry, Section 2, M. 765, 1960, p. 465) indicate that this order must have an effect also upon polycondensation. The authors achieved the polycondensation by heating the reactant mixtures in sealed glass ampuls or in an autoclave with exclusion of atmospheric oxygen to temperatures from 70 to 250°C. This reaction can be represented in a general form by the equation:



acetylene, acetone produces polymethyl acetylene, acetophenone produces polyphenyl acetylene, and so on. The polymers obtained are dark-brown or black powders with increased heat resistance characteristic of high-molecular, polyconjugate systems. They display semiconductor properties and characteristic epr spectra. The solubility of polymers in organic solvents, such as acetone or benzene, depends on the degree of polycon-

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27878

Polycondensation of acetone...

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B103/B101

densation; they are soluble at low degrees but insoluble at high degrees. The degree of polycondensation and the yield of solid polymers rise with increasing amount of catalyst, temperature, and reaction time. The structure of polyvinylenes is confirmed by infrared spectra. The spectrum of polymethyl acetylene (obtained from acetone in the presence of  $\text{ZnCl}_2$ )

has many features in common with that of polyacetonitrile which, according to its structure, is related with polymethyl acetylene. A wide, intensive band at  $1593\text{ cm}^{-1}$  corresponds to the absorption by the system of conjugate C=C bonds. The bands at  $1352$  and  $1380\text{ cm}^{-1}$  may be ascribed to symmetric deformation vibrations of  $\text{CH}_3$  groups. The band at  $960\text{ cm}^{-1}$  corresponds to nonplanar C-H vibrations in the principal chain. An extensive polycondensation of carbonyl-containing monomers can be obtained by previous ordering of monomer molecules in complexes with metal halides unsaturated with respect to coordination which simultaneously play the part of dehydrating catalysts. Thus, various heat-resistant polyvinylenes of a considerable molecular weight can be produced. There are 1 figure, 1 table, and 11 Soviet references.

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S/020/61/141/001/020/021  
B119/B108

AUTHORS: Razikov, K. Kh., Markova, G. S., and Kargin, V. A.,  
Academician

TITLE: Secondary structures in caprone fibers

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 141, no. 1, 1961, 157-160

TEXT: The authors studied the formation of secondary structures during crystallization of condensed-phase polyamides. Approximately 1-mm thick caprone threads stretched to the fivefold length were investigated.

Recrystallization was caused by annealing for 1-1.5 hr at 205°C, and subsequent slow cooling to room temperature. Approximately 200-Å thick fiber cross sections were studied by a YMB-100 (UEMB-100) electron microscope. The preparations were obtained by means of a Söstrand Ultra-microtome LKB-Producter. Results: The oriented, but not pretreated fibers show only a slight secondary structure (microfibrils ~100 Å thick and a few μ long). During recrystallization a considerable increase of the existing secondary structures occurs. The microfibrils start branching until they finally turn into little crystals. The secondary structures

Card 1/2

Secondary structures in caprone ...

S/020/61/141/001/020/021  
B119/B108

are formed by aggregation of these little crystals which form irregular structures with diameters of from 1 to 10 $\mu$ . The space between the crystalline macrofibrils is filled out by amorphous polymeric substance. There are 3 figures and 3 references to English-language publications which read as follows: A. Keller, J. Polymer Sci., 36, 361 (1959); P. H. Geil, J. Polymer Sci., 44, 449 (1960); W. O. Statton, P. H. Geil, J. Appl. Polymer Sci., 3, 9, 357 (1960).

ASSOCIATION: Fiziko-khimicheskiy institut im. L. Ya. Karpova  
(Physicochemical Institute imeni L. Ya. Karpov)

SUBMITTED: June 12, 1961

Card 2/2

53830

4209

5/000/61/141/002/018/027  
B101/B147

AUTHORS:

Kargin, V. A., Akademich, V. A., Papisov, I. M.,  
and Zubov, V. P.

TITLE:

Role of phase transitions in polymerization processes of  
solid monomers

PERIODICAL:

Akademiya nauk SSSR. Doklady, v. 141, no. 2, 1961, 389-392

TEXT: The problem of rapid polymerization in solid state at low temperatures is discussed. A 0.03 mm thick layer of acrylonitrile (melting point  $-83^{\circ}\text{C}$ ) and magnesium (100 : 1) was condensed in vacuo onto a glass plate which was placed at the face of a copper cylinder cooled with liquid  $\text{N}_2$ . The condensate was a crystal-clear film. After  $\text{N}_2$  was removed the copper cylinder was slowly heated ( $2^{\circ}\text{C}/\text{min}$ ). Temperature was measured with thermocouples, and the thermogram (Fig. 2) was recorded by an ЭПН-09 (EPP-09) electronic voltmeter. Samples activated with Mg underwent explosive polymerization either at  $-160^{\circ}\text{C}$  or at  $-135^{\circ}\text{C}$ . The degree of conversion was 100%. At these temperatures, the thermogram of non-activated acrylonitrile shows exothermic effects. The effect observed at  
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S/020/01/141/002/010/000  
B101/B147

Role of phase transitions ..

-160°C is ascribed to the crystallization of monomer glass on reaching Tamman temperature. The effect observable at -135°C, and the reason why polymerization starts once at -160°C and once at -135°C, are still unexplained. At -135°C a secondary, additional orientation of the resulting microcrystalline substance might take place. The two transitions are irreversible. In methylmethacrylate and Mg condensed onto a glass sphere which was cooled to -75°C (apparatus described in Vysokomolek. soyed., 1, 265 (1959)), the polymerization process in polarized light could be observed due to birefringence of the crystals. At this temperature, the molecules could already migrate and add to the forming crystallization nuclei. Spherulites were formed. The characteristic Maltese cross could clearly be seen. In this system, slow polymerization took place. It began at the edges of the spherulites and in fissures. Shifting of the crystal - polymer interface could be observed with the aid of birefringence which vanished during polymerization. Contrary to N. N. Semenov's hypothesis (Khimiya i tekhnologiya polimerov, no. 7-8, 196 (1960)) that rapid polymerization takes place preferably in ideal crystals, experimental data showed that this effect occurs in defect crystals while ideal crystals polymerize slowly. Lattice defects are

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Role of phase transitions ...

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B101/B147

produced in the latter by the growing polymer chain and cause disruption of it. Reactivation is only possible after relaxation of stress. These processes occur at interfaces and can be accelerated by factors which facilitate the regrouping of monomer molecules, e.g., adsorbed layers of solvents. Rapid polymerization takes place if easier migration of defects is possible. This is the case with phase transitions in which the molecules become mobile. A paper by E. I. Adirovich (DAN, 136, 117 (1961)) is mentioned. There are 2 figures and 14 references: 11 Soviet and 3 non-Soviet. The two most recent references to English-language publications read as follows: A. J. Restaino, R. B. Mesrobian et al., J. Am. Chem. Soc., 78, 2939 (1956); T. A. Fadner, H. Morawetz, J. Polymer Sci., 45, 475 (1960).

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova (Moscow State University imeni M. V. Lomonosov) X

SUBMITTED: June 19, 1961

Card 3/4



KARGIN, V.A.

The expansion of the realm of monomers in connection with progress in polymerization.

Report presented at the 12th Conference on High Molecular-weight compounds devoted to monomers, Baku, 3-7 April 62

ANDRIANOVA, G.P., KARGIN, V.A.

Effect of microscopic structures on the mechanical behavior of isotactic polypropylene.

Report presented at the 13th Conference on high-molecular compounds  
Moscow, 8-11 Oct 62

KOZLOV, P.V., TIMOFEEVA, V.G., KARGIN, V.A.

Effect of small admixtures of low-molecular substances on the mechanical properties of rigid chain polymers.

Report presented at the 13th Conference on high-molecular compounds  
Moscow, 8-11 Oct 62

35201

S/064/62/000/002/003/008  
B101/B144

15.9000

AUTHORS:

Berlin, A. A., Kronman, A. G., Yanovskiy, D. M., Kargin,  
V. A.

TITLE:

Impact resistant materials on the basis of graft copolymers  
of polyvinyl-chloride with elastomers

PERIODICAL:

Khimicheskaya promyshlennost', no. 2, 1962, 20-24

TEXT: A survey of publications concerning an increase of the impact strength of polyvinyl-chloride (PVC) by copolymerization with methyl-vinyl pyridine rubbers and nitrile rubbers is given and data from the authors own studies are repeated. In addition, the Huggins constant  $K'$  for copolymers of PVC with CK MBT-15 (SK MVP-15), CKH-18 (SKN-18), and CKH-26 (SKN-26), calculated from the intrinsic viscosity is mentioned. The intrinsic viscosity was determined in cyclohexanone.

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Solution investigated	$[\eta]$	K'
SK MVP-15	0.8	0.346
PVC	0.835	0.433
Reaction product	0.72	0.617
Mechanical mixture	0.8	0.356
SKN-18	1.78	0.656
PVC	1.01	0.248
Reaction product	0.915	0.397
Mechanical mixture	1.14	0.272
SKN-26	2.38	0.511
PVC	1.01	0.248
Reaction product	0.95	0.644
Mechanical mixture	1.085	0.491

The lower intrinsic viscosity of the copolymers is explained by their inferior solubility. The high K' is caused by a branched structure. When copolymerizing PVC with nitrile rubber or methyl-vinyl pyridine rubber, reaction between the Cl of PVC and the N of nitrile and pyridine,

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respectively, sets in under formation of tridimensional structures.  
There are 4 figures, 3 tables, and 19 references: 9 Soviet and 10 non-Soviet. The four most recent references to English-language publications read as follows: L. C. Bateman, Ind. Eng. Chem., no. 4, 704 (1957); C. Bloomfield, P. Swift, J. Appl. Chem., no. 11, 609 (1955); J. E. Gordon, C. C. Turrell, J. Org. Chem., 24, 269 (1958); S. E. Bolam, Austral. Plastics, 10, no. 107, 18 (1954).

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BERESTNEV, V.A.; GRECHUSHKINA, N.I.; LITKINA, M.B.; <sup>1</sup>KARGIN, V.A.

Study of the structural characteristics of various viscose  
fibers by means of light microscopy. Khim.volok. no.3:45-48  
'62. (MIRA 16:2)

1. Nauchno-issledovatel'skiy institut shinnoy promyshlennosti  
(for Berestnev, Grechushkina, Lytkina). 2. Fiziko-khimicheskiy  
institut im. L.Ya.Karpova (for Kargin).  
(Rayon)

BERLIN, A.A.; KRONMAN, A.G.; YANOVSKIY, D.M.; KARGIN, V.A.

Materials of high resilience based on graft copolymers of  
poly(vinyl chloride) with elastomers. Khim.prom. no.2:96-100  
F '62. (MIRA 15:2)

(Vinyl compound polymers)  
(Elastomers)



BERESTNEV, V.A.; RAZIKOV, K.Kh.; KARGIN, V.A.

Particular features of the supermolecular structure of various kinds of viscose fibers. Khim.volok. no.4:51-55 '62.

(MIRA 15:8)

1. Nauchno-issledovatel'skiy institut shinnoy promyshlennosti (for Berestnev). 2. Fiziko-khimicheskiy institut im. Karpova (for Razikov, Kargin).

(Rayon)

KARGIN, V.A.; KOZLOV, P.V.; MIRLINA, S.Ya.; KAPRALOVA, Z.A.

Breakdown and rebuilding of protein structures. Vysokom.soed.  
4 no.2:167-173 F '62. (MIRA 15:4)

1. Moskovskiy gosudarstvennyy universitet im. M.V.Lomonosova.  
(Proteins)

S/191/62/000/005/001/012  
B110/B101

AUTHORS: Kargin, V. A., Malinskiy, Yu. M., Ratner, S. B.

TITLE: Development of the mechanics of plastics

PERIODICAL: Plasticheskiye massy, no. 5, 1962, 1-2

TEXT: An understanding of the behavior and service life of plastic products involves studying not only the purely mechanical relaxation processes but also the mechanical-chemical process of destruction, especially through repeated bulk fatigue failure or abrasion. Good mechanical properties are required for (1) use in supporting, shock absorbing, packing, etc., (2) dielectrics, (3) heat insulators, and (4) water- and gas-tight shells. In these respects, the fundamental mechanical indices must be known, such as (1) strength, (2) maximum elongation, (3) elasticity, (4) resilience, and (5) heat resistance. The mechanics of plastics must therefore be developed as an applied science able to evaluate the properties of plastics characterized as: (1) thermo-reactive and thermoplastic, (2) brittle and soft, (3) monolithic and porous, (4) filled and unfilled, (5) isotropic and anisotropic. For this  
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Development of the mechanics ...

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purpose, general mathematical theories need to be elaborated for: (1) strength, (2) elasticity, (3) plasticity, and (4) relaxation, considering the molecular, supermolecular, and macroscopic structure of different plastics. The Komissiya po mekhanike polimerov Goskhimkomiteta (Commission for Polymer Mechanics of the Goskhimkomitet) is compiling records of experimental results regarding: (1) effect of temperature and pressure on viscosity, (2) density, (3) elastic relaxation, (4) coefficient of external friction, (5) thermophysical data, and (6) effect of temperature on the yield curves. By 1963 it is hoped to have so compile the (a) elastic, (b) relaxation and (c) strength properties of all rigid plastics, for various temperatures and static and dynamic loads. Similar records are needed for the behavior of thermoreactive plastics during processing as well as for technical evaluation of foam plastics, films, soft and semirigid plastics. It is also necessary to work out uniform methods for evaluating the properties of plastics as regards workability, and to design suitable experimental apparatus. To afford reliable basis for calculating the strength and hardness of many plastic constructions, a theory of the mechanical behavior of plastics under complicated stresses should be elaborated by the Institutes of the Akademiya nauk (Academy of

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Sciences) in collaboration with universities and leading scientists. The planned Nauchno-issledovatel'skiy Institut po primeneniyu plastmass v mashinostroyenii (Scientific Research Institute for the Application of Plastics in Machine Building) is to supply designers with methods of calculation for complicated machine parts and constructions, and to pursue the development of research methods for plastic products. The Institutes of the AN SSSR (AS USSR), the related industry and advanced schools are to train students conversant with physico-mechanical investigation methods for polymers, in the field of the mechanics of plastics and polymers. Comprehensive studies in all fields appertaining to the mechanics of plastics are to be undertaken in the institutes of the Goskhimkomitet jointly with scientific, technical and other organizations, aiming to achieve highly effective methods of processing, rational application and extensive replacement of expensive materials. ✓

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B101/B110

AUTHORS: Malinskiy, Yu. M., Prokopenko, V. V., Kargin, V. A.

TITLE: Effect of the relaxation rate on the strength of adhesive joints

PERIODICAL: Vysokomolekulyarnyye soyedineniya, v. 4, no. 2, 1962, 299-303

TEXT: The authors studied the dependence of strength of the joint glass - polyvinyl acetate (PVA) - glass on the temperature and the plasticizer content of the polymer (dibutylphthalate, DBP). The specimens consisted of an oblique glass parallelepiped (Fig. 1). 20% acetic solution of PVA was applied to the glass surface and then dried at room temperature on air for 40 min. These glass surfaces were then pressed together with a pressure of  $10 \text{ kg/cm}^2$  at  $80^\circ\text{C}$ . The glue layer was 0.01 - 0.04 mm thick and had no effect on the strength. The strength was measured by loading a cylinder in the cuneiform groove ( $d = 1.76 \text{ mm}$ ). The results (Fig. 2) are explained by the fact that above the vitrification temperature the polymer strength decreases, however, the relaxation rate increases. Thus the

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Effect of the relaxation ...

strength reaches a maximum somewhat below the vitrification temperature. With increasing plasticizer content the vitrification temperature decreases linearly. This could also be proved by thermomechanical experiments with PVA films. The extremum is characteristic of the inhomogeneous stress distribution. A. P. Aleksandrov, S. N. Zhurkov, G. M. Bartenev, V. Ye. Gul', G. A. Patrikeyev, and B. I. Panshin are mentioned. There are 5 figures and 8 references: 5 Soviet and 3 non-Soviet.

ASSOCIATION: Fiziko-khimicheskiy institut im. L. Ya. Karpova (Physico-chemical Institute imeni L. Ya. Karpov)

SUBMITTED: February 16, 1961

Fig. 1: Schematic representation of specimen testing



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KAPRALOVA, Z.A.; MIRLINA, S.Ya.; KOZLOV, P.V.; KARGIN, V.A.; POPOVA, L.A.

Structural transformations in fibrillar proteins. Vysokom.soed.  
4 no.3:321-327 Mr '62. (MIRA 15:3)

1. Moskovskiy gosudarstvennyy universitet imeni Lomonosova.  
(Proteins)



KAPRALOVA, Z.A.; MIRLINA, S.Ya.; KOZLOV, P.V.; KARGIN, V.A.; KHOKHLOVA, V.K.

Structural transformations in globular proteins. Vysokom.soed.  
4 no.3:328-333 Mr '62. (MIRA 15:3)

1. Moskovskiy gosudarstvennyy universitet imeni M.V.Lomonosova.  
(Proteins)

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S/190/62/004/004/011/019  
B117/B138

AUTHORS: Asimova, R. M., Kozlov, P. V., Kargin, V. A., Vtorygin, S. M.  
TITLE: Plasticization of polymers with high-molecular compounds  
PERIODICAL: Vysokomolekulyarnyye soyedineniya, v. 4, no. 4, 1962, 554-559

TEXT: The effect of high-molecular plasticizers (butadiene nitrile rubber CKH-40(SKN-40) on the temperatures of polymer transitions and their mechanical properties were studied. Cellulose acetate butyrate with brittle point of 130°C was used as the polymer. Polymer and plasticizer were mixed in chloroform, the plasticizer concentration having been changed over a wide range. Thermomechanical tests were conducted on samples ranging from pure polymer to pure plasticizer. In the case of compatibility of the two components, the brittle point was found to be strictly proportional to the part by volume of the plasticizer in the system, i. e. interpacket plasticization of the polymer takes place here. The development of such homogeneous systems was observed only for very small amounts of plasticizer (1-10%), and very large ones (90-98%). Microheterogeneous mixtures formed in the remaining concentration range. With a plasticizer concentration of 10-30%,

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Plasticization of polymers...

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the brittle point at first remained constant, which is characteristic of interpacket plasticization. At a concentration above 30%, the system began to become heterogeneous. With a plasticizer content of 40-80%, the brittle points of the two components appeared separately on the thermo-mechanical curves. The temperature transitions of plasticized cellulose acetate butyrate, hardened butadiene nitrile rubber, and their mixtures evidently correspond to these brittle points. Films of cellulose acetate butyrate with different plasticizer concentration were used for dynamometer tests. An increase of the plasticizer content up to 50% did not increase the relative elongation of the samples, but did reduce their tensile strength sharply. The low mechanical strength of plasticized samples is probably due to a microheterogeneity of the system. With a high rubber content (70% by weight) the samples behave like rubber. Calculation of the modulus of elasticity and study of its dependence on the plasticizer concentration produced the following result: When introducing small amounts of rubber, the modulus of elasticity of the polymer is reduced, and remains constant and sufficiently high up to a 60% plasticizer concentration. With a rubber content of 70% the modulus of elasticity of the polymer becomes equal to that of the high-polymer plasticizer. By using high-polymer  
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plasticizers materials with sufficiently high modulus of elasticity may be obtained. The mechanical properties required can, however, only be obtained if homogeneous systems form from polymer and plasticizer, which requires compatibility of both components. Noncompliance with this condition leads to the development of a heterogeneous system and embrittlement of the material. There are 5 figures.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova  
(Moscow State University imeni M. V. Lomonosov)

SUBMITTED: March 15, 1961

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